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AUTHOR Crawford, Michael E.
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ABSTRACT

The literature on symbolic forms of communication was reviewed, and an experimental program was designed to teach a single set of vocabulary to a group of four institutionalized profoundly retarded blind/mute adults through the use of gestures. Literature about deaf/blind persons suggested the use of coactive movement techniques and facilitation of body image and body schema. Behavior therapy studies supported the use of manual communication with varied contingency and experience variables. Finally, from experimental and behavioral psychology, the use of systematic training and engineered environments seemed appropriate considerations. Three phases were planned within the design: first, an attempt was made to identify reinforcers maintaining self stimulatory behaviors and sensory extinction procedures were then implemented; second, Ss were taught a simple set of vocabulary through the use of gestures in a controlled environment; and third, the adaptation and generalization of high frequency words from the training room to daily situations was facilitated. The teaching strategy involved sensory input, motor output, and reinforcement. Applying the general behavioral principle of reinforcement, Ss learned to respond appropriately after exposure to the teaching strategy and reinforcement contingencies. Among recommendations were the following: although generalization to the living environments was not highly effective, the use of naturalized reinforcers and success encountered in the training room suggest future potentials; greater training success was experienced with receptive object identification concepts than with expressive action related words; and elaboration for future experimental teaching strategies might include discriminating between two objects by touch and signing given a verbal cue. (SB)

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FACILITATION OF COMMUNICATION RESPONSES THROUGH NATURALIZED SENSORY REINFORCEMENT IN BLIND MUTE/PROFOUNDLY RETARDED ADULTS

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Michael E. Crawford
College of Education
University of Nebraska-Omaha
60th and Dodge
Omaha, Nebraska, 68182

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FACILITATION FOR COMMUNICATION RESPONSES THROUGH NATURALIZED SENSORY REINFORCEMENT IN BLIND/MUTE/PROFOUNDLY RETARDED ADULTS

Introduction

One of the most difficult diagnostic and treatment problems seen in rehabilitation centers is the multi-handicapped adult who has received only general custodial care throughout life. One of the most challenging sub-populations of low incidence handicaps is the profoundly retarded blind/mute adult. In regards to muteness sometimes no physical or behavioral abnormality can be found except for the delayed speech. Present clinical practice is to place great emphasis upon diagnosis, based on normative (standardized) procedures, prior to attempting traetment. Often, however, low incidence handicaps test results are impossible to obtain or listed as "inconclusive." Recommendations for this "lost" generation frequently list "continued custodial care."

This situation should come as no surprise given the current biases of testing procedures. Psychologists cannot administer a test when they cannot communicate with a client at least at some primitive level. Speech therapists and audologists generally require that a client be willing to

"cooperate" and "try" to imitate or respond to the sounds presented.

From a behavior theory standpoint, the criterion referenced approach is more productive. The lack of a diagnosis per se is not a barrier to initiating treatment. Behavior that is reinforced will be engaged in with distinctive frequency, according to the schedule of reinforcement and the stimulus conditions, up to the limits of capability of the organism. If a specific behavior cannot be obtained in one way, perhaps it can be obtained in another. The appearance of the desired behavior is evidence of success. If treatment is temporarily or relatively unsuccessful, the cumulative record of responses under varied conditions will provide evidence of behavioral deficits that will contribute to diagnosis. In general, the diagnostic problem can be recast, in behavioral terms, as the specification of the conditions under which a specific behavior can be obtained. Since not every effort to shape behavior will be successful, the behavioral engineering process may also specify the conditions under which a response cannot be obtained and indicate the deficit that is responsible.

The task of the behavioral engineer is to develop communication when confronted with a profoundly retarded blind/mute adult. Adler (1975) described language disorder as the inability to aurally understand linguistic symbols

and inability to express such symbols. Theoretically, it would seem possible to shape emitted vocalizations by selective reinforcement. Under these conditions, it would be necessary to shape each utterance into a word which would then be brought under the control of the proper stimulus conditions. For example, one might teach an individual to say "water" in the presence of water and not to say it under other stimulus conditions. The same procedure would then be followed for each new word to be learned. It does not appear, however, that this is the process that occurs in natural speech development, nor does it seem a feasible procedure for beginning communication therapy.

Furthermore, a strenuous problem is presented in profoundly retarded blind/mutes because of the lack of echoic behavior. When verbalization is limited to primal screams and non-verbal communication limited to random gestures and/or bizarre facial expressions, the clinician is not left with much of an utterance or response process to begin to shape. A multi-sensory teaching strategy is suggested with communication occurring at manual rather than verbal levels. However, the personal characteristics of a profoundly retarded blind/mute are quite limiting clinically.

These individuals often exhibit what appear to the untrained eye as bizarre behaviors. They may arch their backs and pull away when lifted. When objects are placed in their hands, their fingers often curl away from the

object instead of grasping it. They rock, many times using their head as the pivotal point. This is often done in seemingly precarious positions. They have other strange mannerisms such as hair pulling, head banging, head rolling, and teeth grinding. These behaviors seem to enable the individual to make a world of his/her own body, providing satisfaction and pleasure for the self by stimulating the senses. The individual's behavior is totally directed toward things or people which can give pleasurable body sensations. How, then can this individual be taught to communicate with the world and the people in it?

Profoundly retarded blind/mutes may enjoy some forms of limited vision, particularly light gazing. This may take the form of an obsession; where responses are all channeled toward one goal: looking at light. The light has no meaning, it is merely a pleasurable sensation. It is only a means of seeking stimulation from a highly inaccessible world.

These individuals may have faulty hearing but rarely are they profoundly deaf. Even very deaf people usually hear loud noises and respond to them. Some profoundly retarded blind/mutes may respond to certain sounds, like the click of a radio, showing mementary outward signs of orientation. Some appear to hear selectively, attaching some meaning to a few key words, but the majority of sounds are ignored. Some of the apparent enjoyment of sound may be

enjoyment of vibrations against the body. Much of this has the same characteristic as light gazing; it is on the level of bodily sensation and does not serve to bring the individual into contact with the environment at a communication level.

Profoundly retarded blind/mutes are characteristically unresponsive and unsociable. They find bodily sensations so pleasurable and the environment so confusing that a majority of the enviornment is "turned off." The individual admits only bodily sensations which are rewarding. These things satisfy the individual on the level of sansation and may be considered to be one of the most primitive forms of enjoyment. In order to come into communication with the enviornment, the individual must progress from this level of sensation; (self-stimulation out of necessity) to begin to perceive. The individual must attach some meaning to the impulses received from the senses instead of using these impulses only for primitive gratification.

These individuals must use the body to contact the environment. All communication, whether formal or informal, sophisticated or primitive, involves use of the body. To use the body to communicate, the individual must know it and be able to master it. Profoundly retarded blind/mutes have not learned to reach and grasp accurately; because they can not see objects clearly, because they are not interesting auditorally, or a combination of both factors. Reaching and grasping behaviors may also be inhibited by

the domination of primitive or abnormal reflexes. They have not discovered the more trauitionally and universal method of learning in humans, which is imitation. They must learn to imitate. In order to imitate, the individual must perceive another and do the same. This is obviously a difficult task for the multiply handicapped.

The premise of this study was that by imitating paried speech sounds and movements through systematically accumulated experiences, meaning may be attached to words or objects. The purpose in using sign language with non-verbal individuals is to give them a functional communication system as a foundation for the development of receptive and expressive language.

However, a "ready made" teaching strategy for the development of communication in such a low-incidence handicap was not readily available. A thorough review of the literature in ancillary disciplines was engaged. This process provided a composite of clinical strageties developed with other sub-populations presenting one or more of the deficits under consideration. It was hoped that several clinical insights would be facilitated toward development of an innovative teaching strategy.

Review of Literature

Experimental psychologists have spent consdierable time dealing with facilitation of symbolic forms of

communication. In the last decade, research in the field of animal and human memory and communication has grown at a phenomenal rate. However, even a cursory examination of the literature reveals there is a large gap between human and animal communication research with respect to methodology and theoretical perspective (Medin, 1976). In addition to the obvious species differences, there are numerous procedural differences between studies. Most of these designs deal with infra-human studies concerning symbol manipulation through computer and operant conditioning techniques (DeVine, 1970, Grant, 1976, Jahnke, 1975, Kirk, 1968, and Moise, 1976).

Some researchers, however, have presented arguments for similarities. Jarrard and Moise (1971) argued that procedural similarities existed between the delayed matching-to-sample (DMTS) and the STM paradigm used with humans (e.g., Peterson and Peterson, 1969). They recommended the DMTS task as a means of bridging the gap in knowledge regarding STM processes in animals and humans. They reported that the effects of amount of interpolated activity, repetition of the stimulus, and stimulus difficulty with non-human primates were generally similar to the effects of these variables in human STM.

Despite these limited findings, the efficacy of generalizations drawn from infra-human research is decidedly limited. In addition, the utilization of limited S-R

techniques in conjunction with computer and/or skinner box training is beyond the humanistic sentiments of most investigators.

Some investigations have dealt with other multi-handicapped populations, such as the deaf-blind. These investigators stress the importance that gestures play in the development of communication. The normal deaf child devises natural sign language through gestures (Branigan, 1976, Giles, 1974, and Chambers, 1975). If the child is normally intelligent and properly educated, these natural gestures soon are paired with spoken language, formal sign language, or fingerspelling, or a combination in a total communication approach. The normal child also goes through a period in which sign language is used (Hammer, 1975, and Gill, 1975). The child may have more to say than a limited growing vocabulary can express and so begins the use of natural gestures. These gestures play an important part in the life of the normal child who is by nature motorically oriented (Mann, 1974, and McCatchie, 1974). It is with this method that children first consciously communicate. It is the basic language for all children. A basic vocabulary of natural gestures allows the child to communicate and to understand. Even if the child will never read, speak or fingerspell he can probably learn to make needs known with the use of a few simple gestures.

Of particular importance is the fact that some investigators (Krammer and Rosenfeld, 1975, and Rees, 1974) have been able to make use of gestures in early stages of therapy with adults. A further benefit of the literature concerned with the deaf/blind has been the successful use of programs of co-active movement in facilitating manual communication (Advani, 1973, Allen, 1975, Robinson, 1975, and Simmons, 1975). In the co-active movement process, the therapist guides the learner through a progression of cohensive, mirrored, parallel, and finally independent activity functioning. Progressions are not rigid but are intended as a guide to independence.

An additional theme central to this body of literature has been an emphasis on the development of body image and body concept through systematic exploration of environments (Wertman, 1975, and Klineman, 1975). It should be noted that the majority of the deaf/blind studies have utilized subjects whose cognitive potentials were of a near-normal range, or at least possessed no other interceding conditions. The teaching strategies for these designs were basically engineered for children and presuppose a level of congitive potential that could not be assumed for the population of interest in this investigation.

Many behavior therapists have dealt with the facilitation of expressive and receptive language in the severely and profoundly retarded. Kotkin and Simpson (1976)

identified a sub-population of non-verbal severely mentally handicapped children that did not benefit from traditional therapeutic models of oral production. They outlined procedures for using sign-language with non-verbal children; however, their subjects were sighted.

Recently some investigators (Haskett and Hollar, 1978) have proposed the use of learning strategies involving sustained response-dependent experiences utilizing a wide variety of objects and events. Other researchers (Yarrow, Rubenstein, Pedersen, and Jankowski, 1972) suggest that contingent experiences are essential to developmental progress in communication. Exposure to such contingencies might, therefore, lead to development of repetoires of instrumental activity. These trends, however, were developed with severely and profoundly retarded subjects who possess no additional physical, visual, auditory, or vocal disabilities.

The scarcity of research for several and profoundly retarded blind adult mute's left the investigator with few proven clinical tools. What was attempted was a collation of the accrued clinical insights and general principles of human motivation and learning from allied areas. This literature suggested a number of principles applicable in the construction of a teaching strategy. The direction of the research design was also influenced by these ancillary

investigations. Major principles included as elements of the program follow.

The literature about deaf/blind persons, suggested the use of co-active movement techniques and facilitation of body image and body schema. From the literature about speech therapy and aural rehabilitation the importance of the use of gestures as a facet of total communication was indicated. Behavior therapy studies with severely and profoundly retarded children (not otherwise impaired) supported the use of manual communication with varied contingency and experience variables. Finally, from experimental and behavioral psychology (infra-human) the use of systematic training and engineered environments seemed appropriate considerations.

All of these components seemed relevant in the design of the experimental program. In programming for a blind/mute profoundly retarded adult, the "marriage" of techniques, utilized with various other low-incidence populations, into a multi-sensory approach seemed the most feasible way to proceed. The teaching strategy for this process had to address both receptive and expressive language capacities.

Assumptions of this Study

The program design process began through generation of a list of several program assumptions; 1) The first step

in developing communication, the use of gestures, requires building a firm foundation through teaching elements of basic interaction that the individual has failed to incorporate since childhood. 2) The client-therapist relationship is primary to motivation and a sense of security. Development of such should always be prerequisite to programming. The therapist should not jeopordize this relationship merely to gain instructional control (use of aversive conditioning). 3) All human beings regardless of their potentials and status within the life cycle are capable of change. 4) Individuals can be systematically helped to develop body image and concept. 5) If an individual has some way of consciously communicating wants, they are more companionable than those who cannot. They contrast sharply with those who never reach out of themselves and are totally involved with their own body.

Finally, researchers have used varied methods in gaining instructional control of subjects. The deceleration of self-stimulating behaviors has been attempted utilizing overcorrection techniques (Foxx and Azrin, 1973) through application of aversive techniques via shocks and slaps (Bucher and Lovass, 1967) and through the use of edibles and primaries in positive shaping (McKinnery, 1962). The utilization of such techniques, however, generate ethical concerns of sufficient scope (Estein, 1974) to place them

beyond consideration of the humanistic approach and clinical assumptions of this investigation.

Program Design

Purpose of this Study

The focus of the experimental program was to teach a single set of vocabulary to a group of four institutionalized profoundly retarded blind/mute adults through the use of gestures (adapted manual communication techniques) paired with naturalized reinforcers.

Description of Subjects

Subjects ranged in ages from John (S^1) 27, Peter (S^2) 33, Jane (S^3) 21, and Bob (S^4) 33. Ages at institutionalization were John (S^1) 4 years, Peter (S^2) 2 years, Jane (S^3) 6 years and Bob (S^4) 18 months.

Psychological testing results for all four subjects indicated a profound range of retardation. Comments typical to all four were: untestable, unmanageable, psychologically terminal, unresponsive, etc.

John (S^1) and Peter (S^2) were both non-ambulatory. Jane and Bob would walk with physical assistance.

Medical workups indicated that Jane and Bob possessed some reaction to light and may possess limited shadow vision. John and Peter were both diagnosed totally blind. Audiometric testing for all four was impossible to obtain. John and Peter did not seem to orient to any sounds, including

startle response testing. John was completely mute, all other S's would verbalize in terms of moans, screams, and gutteral vowel sounds on an infrequent basis. All four S's spent the majority of their waking hours engaged in self-stimulation. John (S^1) and Peter (S^2) received medications for seizure control (epilepsy).

Definitions

profoundly retarded--In this study refers to individuals whose institutional psychological testing records indicate a standard Binet score below the I.Q. range of 20, or in the case of no score have been clinically diagnosed as untestable or psychologically "terminal."

blind/mute--is defined as those individuals who medically have been diagnosed legally blind and who possess no developed spoken communication/language abilities.

self-stimulation--refers to the general range of behavior in which individuals receive self-generated auditory, proprioceptive, olfactory, or other sensory consequences. Specific behaviors include (but are not limited to) rocking back and forth, shaking the head side to side, flapping the wrists, smearing fecal material, and/or multiple combinations of these.

cueing--refers to a specific therapist teaching behavior as in verbally or physically delivering a command/stimuli.

prompting--refers to a specific therapist teaching behavior in which the therapist physically aids/initiates a response to a cue by physical/hand-on manipulation of the subject.

co-active movement--is a specifically sequenced teaching strategy utilizing cueing and prompting techniques. A specific relation sequence (relation sequence refers to the learner's body in relation to the therapist's) involving four steps is followed. The steps are cohesive (complete physical guidance), mirroring (learner mimicks therapist's lead), parallel (learner and therapist perform simultaneously), and independent (learner functions solitarily with cue only).

Procedures

Three-phases were planned within the design. First, an attempt was made to identify reinforcers maintaining self-stimulatory behaviors. Sensory extinction procedures were then implemented in which auditory, proprioceptive, or other sensory consequences were systematically removed. This was done through substitution of more acceptable reinforcers, compatible with the natural self-stimulatory responses. This phase was necessary in order to gain instructional control of S's. Later these "naturalized" reinforcers were reintroduced in a reversal design as programming contingencies. In the second phase of programming, subjects were assessed as to their

participation in the training paradigm where preferred kinds of sensory stimulation were produced.

Within phase two the teaching strategy was dependent upon the individual receiving appropriate stimuli and reinforcement through the remaining tactile, kinesthetic, and auditory systems available.

The focus of phase II was to teach a simple set of vocabulary through the use of gestures (adapted manual communication techniques) in a controlled environemnt. Criteria for vocabulary selection were that words held particular relevance to daily living situations. By utilizing words of high frequenty use, it was hoped adaptability and generalization from the training room to daily living situations (phase III training) might be facilitated with greater ease.

The vocabulary concepts chosen for training were in two divisions, these were: object identification-spoon, shoe, brush, ball and glass; action concepts-wash, comb, throw, eat, and drink.

The teaching strategy involved three major components; sensory input, motor output, and reinforcement. Each component was cued with a series of progressions and levels involving the principles of co-active movement. Cues, prompts, and co-active movement assistance began at high levels. These were faded on a variable interval (IV) schedule as learning progressed.

Training involved both object identification (such as spoon and brush) and action concepts (such as eat and wash). Seperate teaching strategies were utilized for the two sets of words. Initial training focussed on receptive capabilities for object concepts. The schema below illustrates the training model for both vocabulary sets (see Figure 1).

insert Figure 1 about here

A complete sample behavioral objective and illstrative teaching strategy, utilizing forward chaining for one of the program words is presented as a further guide to the program design.

Behavioral Objective: Given the verbal command "____say wash" the learner will say/sign the word wash ten of ten consecutive trials.

Step 1;

sub-1; The learner is manually guided through the sign for wash, paired with the verbal cue "____say wash."

sub-2; The therapist leads the learner's hands through the motion of washing and says "____wash."

sub-3; While the learner is washing his/her hands the therapist will intervene and manually

guide the learner through the sign for wash while saying "_____say wash." Reinforce.

Step 2;

sub-1; same as before

sub-2; The therapist leads the learner's hands to the running water and says "_____wash."

sub-3; same as before.

Step 3;

sub-1; same as before

sub-2; Given the command "_____wash" the learner will spontaneously wash his/her hands.

sub-3; same as before.

Step 4;

sub-1; same as before

sub-2; same as before

sub-3; While the learner is washing the therapist will intervene and guide the learner's hands to form the proper signing position. The learner will then complete the sign (motion) given the verbal command "_____ say wash." Reinforce.

Step 5;

sub-1; same as before

sub-2; same as before

sub-3; While the learner is washing the therapist will physically cue the learner to move

his/her hands to the proper signing position paired with the verbal command "_____say wash." The learner will complete the sign. Reinforce.

Step 6;

sub-1; same as before

sub-2; same as before

sub-3; While the leraner is washing the therapist will give the command "_____say wash" the learner will stop washing and say the word wash. Reinforce.

Step 7;

sub-1; The therapist will guide the learners hands and form them to the proper signing position. The learner will then complete the sign (motion) given the command "_____ say wash."

sub-2; same as before

sub-3; same as before.

Step 8;

sub-1; The therapist will physically cue the learner to move his/her hands to the proper signing position paired with the verbal cue "_____say wash."

sub-2; same as before

sub-3; same as before.

Step 9;

Given the command "_____say wash" the learner will sign wash. Reinforce with complete hiearchy.

Step 10;

Given the command "_____say wash" the learner will sign the word wash. When the learner signs wash, fade the reinforcer (primary) on a VI schedule.

Results

Phase I Training

All S's participated in varied forms and combinations of self-stimulatory behavior. It was hypothesized that the multiple behaviors of rocking back and forth, shaking the head side to side, and flapping the wrists involved the elements of tactile proprioceptive and kinesthetic sensory feedback. It was further hypothesized that a large vibrator would successfully replicate sensory impulses to a sufficient degree to serve as a surrogate. By making use of this "naturalized" reinforcer self-stimulation would be masked and attention to task elevated.

Attention to task was defined as the subject orienting his/her head towards the experimentor's voice and not engaging in self-stimulatory behaviors for ten seconds. Target behavior was a 90% response compliance over ten trials with reinforcement. If S successfully oriented and did not self-stimulate for ten seconds, then ten seconds of

stimulation from the vibrator paired with verbal praise was delivered. All initial program shaping took place in a small sound proofed training room, thus competition from the environment for all S's attention was controlled.

During Phase I training the effect of the vibrator massage as a sensory extinction on the S's self-stimulatory behavior was measured. During the initial baseline, S's maintained a variable but generally high rate of self-stimulation for the half hour measurement over ten sessions. Response to the command "(name) listen" was quite low. In contrast during modification when the vibrator was added as an immediate reinforcement for attending to task (orienting head, ceasing stimulation) the high percentage of time spent in self-stimulation soon ceased. When the vibrator consequences were removed (extinction phase), self-stimulatory behaviors immediately returned. During re-modification, vibrator massage was re-introduced and behaivors returned quickly to the acceptable levels present during initial modification. During the second spontaneous recovery phase responses remained nearer to instructional levels suggesting that S's were beginning to orient and relate to clinicians and the outward environment.

These data suggest that self-stimulatory behavior was being maintained by tactile, kinesthetic and proprioceptive stimulation. When a reinforcer of equal durability was introduced self-stimulation behaviors

diminished and attention to task reached levels of instructional control.

Identification of the vibrator as a naturalized reinforcer for all subjects were similar to the procedures illustrated with one exception. In addition to the body rocking motion, head and hand shaking, and tensing of upper body muscle groups of the other subjects, Jane (S^3) derived additional reinforcement through the olfactory mode. Jane would participate in anal digging and playing with fecal material. During the activity she would frequently bring her hands to her nose in repetitive alternating movements. The limited use of cologne, delivered through waving a hankerchief under Jane's nose, in combination with vibratory stimulation produced a reinforcement contingency of sufficient power to gain instructional control. Eventually all S's began to favor surrogate stimulation over self-stimulation. Complete data for all S's during Phase I training may be found in Figure II.

insert Figure II about here

Phase II Training

In Phase II training clinicians attempted to discern if S's would work for the programmed reinforcer by inserting the instructional requirements of the teaching strategy prior to the delivery of the reinforcer's. The vocabulary

concepts were chained to the verbal request to attend to task, so that S's began to work to receive the reinforcer.

The group began training with two words from the object identification vocabulary list. Progress was initially tedious. Utilizing many trainers and two training sessions daily, six days each week, subjects began to develop skills. Training sessions were one half hour in length. John (S^1) achieved criteria (90% compliance) for all five objective identification words in 12 weeks (122 sessions), Peter (S^2) in 15 weeks (150 sessions), Jane (S^3) in 16 weeks (162 sessions), and Bob (S^4) in 17 weeks (175 sessions). As criteria for individual words were reached, these words were used as the next training sessions warm-up exercises.

Acquisition for the second vocabulary set of action concept words was much longer. John (S^1) attained criteria for all five action concept words after 19 weeks (102 sessions), Peter (S^2) and Jane (S^3) after 29 and 28 weeks respectively (330 and 336 sessions), and Bob (S^4) only after 27 weeks of training (325 sessions). During training for the second vocabulary set the original vocabulary (object identification) were repeated on a maintenance schedule, one daily, during the first training session. An illustration of training progress for John (S^1) may be found in Figure III. This data demonstrates the proceudres and recording methods utilized for all S's.

insert Figure III about here

Phase III Training

Only after all S's reached criteria for all ten words in the training room was Phase III training, generalization to the daily living environment, attempted. During initial generalization to different environments (bedrooms, dining room, recreation room, etc.) performances degenerated sharply. Precise delivery of the vibrator as reinforcement was hindered at first because of problems with extension cords. A protable battery power pack was implemented and this alleviated the problem.

Frequency of self-stimulation outside of the training room during Phase I and Phase II training had remained unaffected. Baseline rates prior to and during training remained unchanged. Throughout Phase III training (generalization) however, baseline rates did adjust. This decline in overall self-stimulation indicate's the possibility of a favorable secondary effect for the training (See Figure IV).

insert Figure IV about here

Fading of reinforcer was attempted only after individual response levels were stabilized in the new enviornment. Direct physical contact as in brisk rubbing, hugging, and stroking were gradually substituted on a VI

schedule as the vibrator was faded. This substitution was established so that all staff members (and some peers) could make use of the program without the need for mechanical assistance (the cologne was faded for Jane (S^3) simultaneously with the vibrator).

Only in three of four subjects were new language behaviors successfully generalized from the training room to new environments. Of these three, only two subjects (S^1 and S^2) re-achieved training room criteria after the mechanical aid (vibrator) was faded from the reinforcement hiearchy. Total training time for each subject may be found in Figure V.

insert Figure V about here

Following the conclusion of Phase III training a maintenance program was established for all S's in which practice of the new behaviors was delivered daily. A post-intervention follow-up at three months found subjects able to make criteria on vocabulary (without mechanical reinforcement and within the daily living environments) at levels indicated in Figure VI.

insert Figure VI about here

Discussion

These results are hardly adequate in comparison to those that might be obtained in highly controlled laboratory studies. They are by no means inadequate, however, for the conditions that exist in an unprotected, free-field study in which many possibly important variables are not under the experimentor's control. For example, in several sessions medications for control of seizures were being adjusted in S^1 and S^2 with a resulting drowsiness. Similarly, other experimentally irrelevant situations interfered or delayed some sessi s. These are the conditions, however, under which a good deal of pioneer experimental work with low-incidence handicapped populations may have to be done.

On the other hand, the gains are not insignificant. In this study, what might be called psychologically "terminal case's" have been altered in a relatively brief period. Mute, uncommunicative, anti-social behavior was decreased and communication skills were increased in a positive direction in the form of manual communication.

Approximations of true initative (echoic) behavior were confirmed. Clinicians believe that additional primary communication and secondary affective gains can be made with these individual cases and that the procedures described are worthy of additional study with other populations.

Conclusions

Attempts to modify or remove behavioral deficits of low-incidence multiple handicaps need not wait upon full and precise diagnosis. Case studies were presented in which an effort was made to establish conditions under which mute, blind, profoundly retarded adults, who had other serious physical handicaps and behavioral deficits of unknown origin and scope, could exhibit the precursor to imitative behavior; namely, to make and relate manual signs of communication to particular objects and events within a short interval after the experimentor had given the appropriate stimulus. Applying the general behavioral principle of reinforcement, modified from techniques utilized successfully with populations of lesser handicaps and varying characteristics, the subjects learned to respond appropriately after exposure to the teaching strategy and reinforcement contingencies. Additional empirical evidence indicating progress in these cases and applicability of the procedures to other cases or populations is as of yet forthcoming. The following recommendations with regard to future research directions seem applicable;

1) Although generalization to the living environments was not highly effective, the use of naturalized reinforcers and success encountered in the training room suggest future potentials.

2) Greater training success was experienced with receptive object identification concepts than with expressive action related words. This reinforces formation in the human learning hiearchy, and suggests a starting point for program development.

3) Elaboration for future experimental teaching strategies might include discriminating between two objects by touch and signing given a verbal cue, and expanding concepts to include training for number identification and prepositions of position.

4) Other areas appear to suggest possibilities, primarily by clicical observation. In relative human terms, the secondary (affective) gains appear potentially as meaningful as the target behavior outcomes. Observation of emotional adjustments over this period reflected positive responses to encouragement and praise. Subjects began to show signs of socialization and affection even though non-verbal. All subjects displayed less crying, fear, and tantrum behaviors. In total, clinicians were amazed at the changes in all subjects throughout the course of training, and at the stabalizing effect of training upon emotional states.

The results of this study, together with previous research, suggest that many low-incidence multi-handicapped individuals have human potentials that are untapped. Further research is indicated to discover those clinical tools essential to instilling incentive, motivation, and in providing appropriate program direction and guidance for those with severe learning problems.

Summary

Criticism of traditional methods of diagnosis in favor for criterion referenced testing has become a major focal point of education for the multi-handicapped in recent years. Research to support such comments is sparse at the applied level however.

This study utilized a unique experimental teaching procedure emphasizing individualization of programming and precise task analysis of activity. In beginning research the orientation toward profoundly retarded blind/mute individuals provides a much needed reference point. The focus on basic communication skills is illustrative of the severity and complexity of the educational problems programmers and therapists are seeking success to.

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